Idaho National Engineering and Environmental Laboratory

INEEL/EXT-99-0040

Process Description and Operating History for the CPP-601/-640/-627 Fuel Reprocessing Complex at the Idaho National Engineering and Environmental Laboratory INEEL/EXT-99-00400

E.P. Wagner

Published June 1999

Idaho National Engineering and Environmental Laboratory
Lockheed Martin Idaho Technologies Company
Environmental Management, Inc.

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Acronyms

ALARA	as low as reasonably achievable
ANN	aluminum nitrate nonahydrate
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFD	cell floor drain
CPM-DOG	Continuous Process Modification - Dissolver Off Gas
DDL	Decontamination Development Laboratory
DOE	Department of Energy
E-DOG	E-cell Dissolver Off Gas
EDP	Electrolytic Dissolution Process
EDTA	ethylene diamine tetraacetic acid
ESL	Emission Spectroscopy Laboratory
FDP	Flourinel dissolution process
FRC	Fuel Reprocessing Complex
HCL	Hot Chemistry Laboratory
HF	hydrofluoric acid
HPP	Headend Processing Plant (originally Hot Pilot Plant)
HPP	Hot Pilot Plant
HWMA	Hazardous Waste Management Act
IAX	First Cycle A column extractant
IDAPA	Idaho Administrative Procedures Act
IDW	First Cycle D column wash
IISW	second mixer-settler wash
IIISW	third mixer-settler wash
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
ISW	first mixer-settler wash
MCC	Multi-Curie Cell
MHC	Mechanical Handling Cave
NWCF	New Waste Calcining Facility
OSL	Old Shift Laboratory
OU	operable unit
PEW	process equipment waste
PM	Process Makeup
PTS	Pneumatic transfer system
PTV	Product Transfer Vessel
RAF	Remote Analytical Facility
RAL	Remote Analytical Laboratory
RCRA	Resource Conservation and Recovery Act
SOG	Sample Off Gas
STR/SIR	Submarine Thermal Reactor/Submarine Intermediate Reactor
TBP	tributylphosphate
TCLP	Toxicity Characteristic Leaching Procedure
VCO	Voluntary Consent Order
VOG	Vessel Off Gas
WINCO	Westinghouse Idaho Nuclear Company

Area Designations

CPP-601

PM	Process Makeup	Second Story
PO	Operating Corridor	Ground Floor
SJ	West Sample Corridor	Ground Floor
SK	East Sample Corridor	Ground Floor
SL	SOG Blowers	Ground Floor
PT	Service Corridor	First Level Subgrade
VT	South Vent Tunnel	First Level Subgrade
WT	West Vent Tunnel	First Level Subgrade
WK	East Vent Tunnel	First Level Subgrade
PA	Access Corridor	Second Level Subgrade
WA/WF	Tank Control Rooms	Third Level Subgrade
WB/WC/WD/WE	Pump Pits	Third Level Subgrade
WT	Waste Trench	Third Level Subgrade
WG/WH	PEW Tank Vaults	Fourth Level Subgrade
A – Z	Process Cells	Varies

CPP-602

LA	Second Story	Second Story
LB	First Story	Ground Level
LC	Basement	First Level Subgrade
LD	Waste Trench	Second Level Subgrade

CPP-627

OSL	Old Shift Lab	Second Story
RAF	Remote Analytical Facility	Ground Floor
ESL	Emission Spectroscopy Lab	Ground Floor
DDL	Decontamination Development Lab	Ground Floor
HCL	Hot Chemistry Lab	Ground Floor
MCC	Multi Curie Cell	Ground Floor

CPP-640

HM	Process Makeup	Second Story
MHC	Mechanical Handling Cave	Second Story
HO	Operating Area	Ground Floor
HS	Sample Corridor	Ground Floor
HA	Access Area	First/Second Levels Below Grade
HV	Vent Tunnel	First Level Below Grade
HW	PEW Tank Vaults	Third Level Below Grade
HC1 – HC5	Process Cells	Varies

Area Designations (con't)

CPP-666

FA	Access Level	Below Grade
FC	Process Cell	Varies
FO	Operating Area	Ground Level

CPP-684

RAL	Remote Analytical Lab	Ground Floor

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1.0 INTRODUCTION

The Fuel Reprocessing Complex (FRC)(CPP-601/640/627) at the Idaho Nuclear Technology and Engineering Center (INTEC) was used for reprocessing spent nuclear fuel. The complex, built in the early 1950's, was in operation until 1992, when the Department of Energy (DOE) announced the reprocessing portion of the INTEC mission would be phased out. The reprocessing facilities in CPP-601/640/627 are consequently scheduled to be deactivated. As part of the deactivation process, three Resource Conservation and Recovery Act (RCRA) interim status units located in the complex must be closed. The units are the CPP-601 WG/WH Storage and Treatment Tanks and associated ancillary equipment, the CPP-640 Headend Process Storage Tanks and associated ancillary equipment, and the D-Cell, a container storage unit.

The FRC contained a very complex chemical process, involving dozens of process vessels and miles of piping. Many of these pieces of equipment processed solutions which contained hazardous constituents. Other hazardous constituents such as lead, asbestos, and PCB's were incorporated into the building structures. Spent fuel contained many intensely radioactive fission products, as well as a range of transuranic elements. All process equipment and structural surfaces in the process cells and downstream ventilation systems retain varying levels of radioactive contamination. In addition, several known and potential leak sites to the soil beneath the FRC exist.

Formulation of a closure plan that addresses all these issues will be a very complex task. This document gathers the historical information necessary to provide a rational basis for such a plan. Included are descriptions of process operations and the operating history of the FRC. A set of detailed tables record the service history and present status of the process vessels and transfer lines.

Extensive cleanup operations have been conducted in the FRC. Beginning with the close of Flourinel dissolution process (FDP) in 1988, uranium sweepdown and chemical decontamination were conducted in the first cycle process cells to allow maintenance and construction activities. These activities were expanded to include every cell in preparation for the Buried Line Replacement Project. This project installed RCRA compliant waste piping in portions of the FRC, and isolated those portions of the piping that remained non-compliant.

Following the termination of the FRC reprocessing mission, a final run of the second and third cycle and denitrator system was required to remove uranium solutions from the FRC. This was followed by flushing for uranium sweepdown. Finally, process equipment was flushed to assure removal of RCRA hazardous material. This document has assembled the available procedures and log entries that describe the flushes. It also presents copies of the results of sampling or other test methods used to prove the effectiveness of the flushes.

Many tanks in the FRC have been identified in an inventory dated September 24, 1998, entitled Voluntary Consent Order (VCO) Action Plan. This inventory remains unchanged as of April 5, 1999. These tanks are identified throughout the document as VCO tanks. The information in this document should prove useful in adjusting the VCO inventory list to include the proper tanks, and in documenting the status of the VCO tanks.